Aircraft radar station TsD-ZOT

1. PURPOSE OF THE STATION

Aircraft radar station TsD-ZOT is designed to work in a complex of means of interception and destruction (RS-2-U missiles) of air targets.

The complex is located on a fighter-interceptor.

The station provides:

· Automatic review of space in a certain sector of the front hemisphere and target detection;

· Semi-automatic target acquisition and automatic tracking by range and angular coordinates;

· Aiming by means of an indicator and destruction of targets by guided missile projectiles;

· Determination, together with the equipment of identification of the nationality of the detected aircraft.

2. PRINCIPLES OF OPERATION

The work of the TsD-ZOT station during a combat mission can be divided into 3 stages:

1. space survey and target detection;

2. exit to the starting position for the attack;

3. target attack and guidance of guided missiles at the target.

In the survey mode, the antenna irradiates the space of the forward hemisphere in the sector of ± 30 degrees in azimuth and ± 12 degrees in elevation.

In elevation, the center of the view sector can be below the rafter horizontal axis of the aircraft at an angle of - 4 degrees, or - 6 degrees, depending on the flight altitude of the aircraft.

The tactical search scheme is shown in Fig. I. The movement of the antenna beam in space is the result of the addition of three simple movements:

1. movement in azimuth to the right and to the left with uniform speed;

2. jumps in elevation up or down at the end of the azimuth line;

3. conical scan.

In the presence of targets in the field of view at ranges of up to 20 km, the reflected high-frequency signals are received by the antenna, converted and amplified by the receiver, and then fed to the indicator of type "B" (azimuth-range).

In fig. 2 shows images of targets on the indicator screen in various cases. Targets on the indicator screen are displayed as horizontal luma grades with vertical marks. The azimuth of the target is measured horizontally from the center of the indicator, and the range along the vertical axis is measured from the bottom of the raster. The position of the target in elevation is displayed by vertical marks "up", "down" located near the marks of the targets.

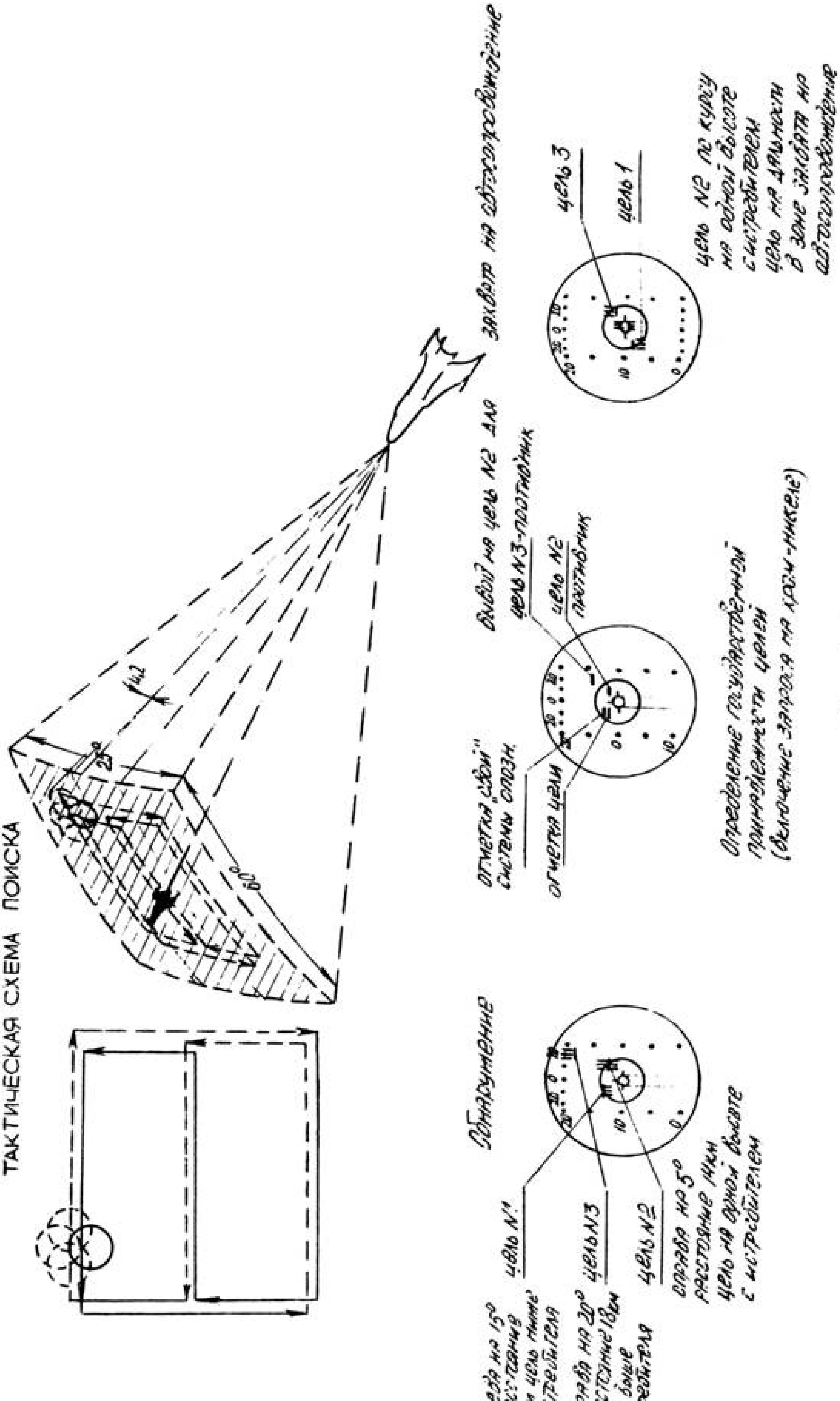

Рис. 2,1

Before launching an attack, the pilot must make sure that the detected aircraft belongs to the enemy military. For this, the pilot turns on the identification system interrogator. If the detected aircraft belongs to its own armed forces, a horizontal "friendly" mark appears above the target mark. The absence of such a mark indicates the detection of an enemy aircraft. In this case, the pilot maneuvers along the course and altitude so that the middle of the target mark coincides with the azimuth zero, and so that vertical marks above and below the horizontal brightness mark of the target are obtained.

When approaching the target at a distance not exceeding 10 km and the fighter's exit to the target, so that it falls within the zone of ± 5 degrees in azimuth on the middle line of sight (ie, there are both vertical marks "up" and "down") , the pilot locks onto the target.

To lock the target, the pilot presses the Lock button on the aircraft control stick. As a result of pressing the "Lock" button, the station antenna stops its view and becomes zero in azimuth and at an angle of 2 degrees to the longitudinal axis of the aircraft, and the autoselector searches for a target by range. If the level of the signal reflected from the target is sufficient for gating the automatic capture, then the target is locked in range and the indicator switches to the aiming mode. In this case, an artificial target mark appears on the indicator screen, shown in Fig. 3, which shows an image of the station indicator screen when operating in the aiming mode. In addition to the artificial target mark, two symmetrical range markers appear on the screen.

After capturing a target, the angular tracking system automatically follows the position of the attacked target in angular coordinates.

The angular position of the target in space corresponds to the position of the center of the artificial target mark, and the interceptor-target range corresponds to the distance from the center of the mark to the range marks. Duplication of range markers is necessary in order to be able to determine the range from one of them, since with a sufficiently large deviation of the center of the artificial target rollback from the center of the indicator screen, another mark will be outside the screen.

By maneuvering the aircraft, the pilot in aiming mode continuously maintains the center of the artificial mark inside the small circle on the screen (the radius of the circle corresponds to one degree of deflection). When the range marker enters the firing zone, the pilot launches shells.

The projectile flight is controlled by the radio beam. To obtain a reference voltage on the projectile, the station from the moment of launch begins to generate special reference signals - "codes", which are shown in Fig. 8. The station sends reference signals when the antenna beam is up-right-down-left relative to the equal signal zone.

The system for generating code signals has a special gyroscopic device, which provides stabilization of the spatial position of the codes during the aircraft rolls in the projectile attack mode.

The station allows two modes of projectile guidance:

1. Mode of guidance shells with automatic target tracking.

2. Mode of guidance of shells with a fixed beam.

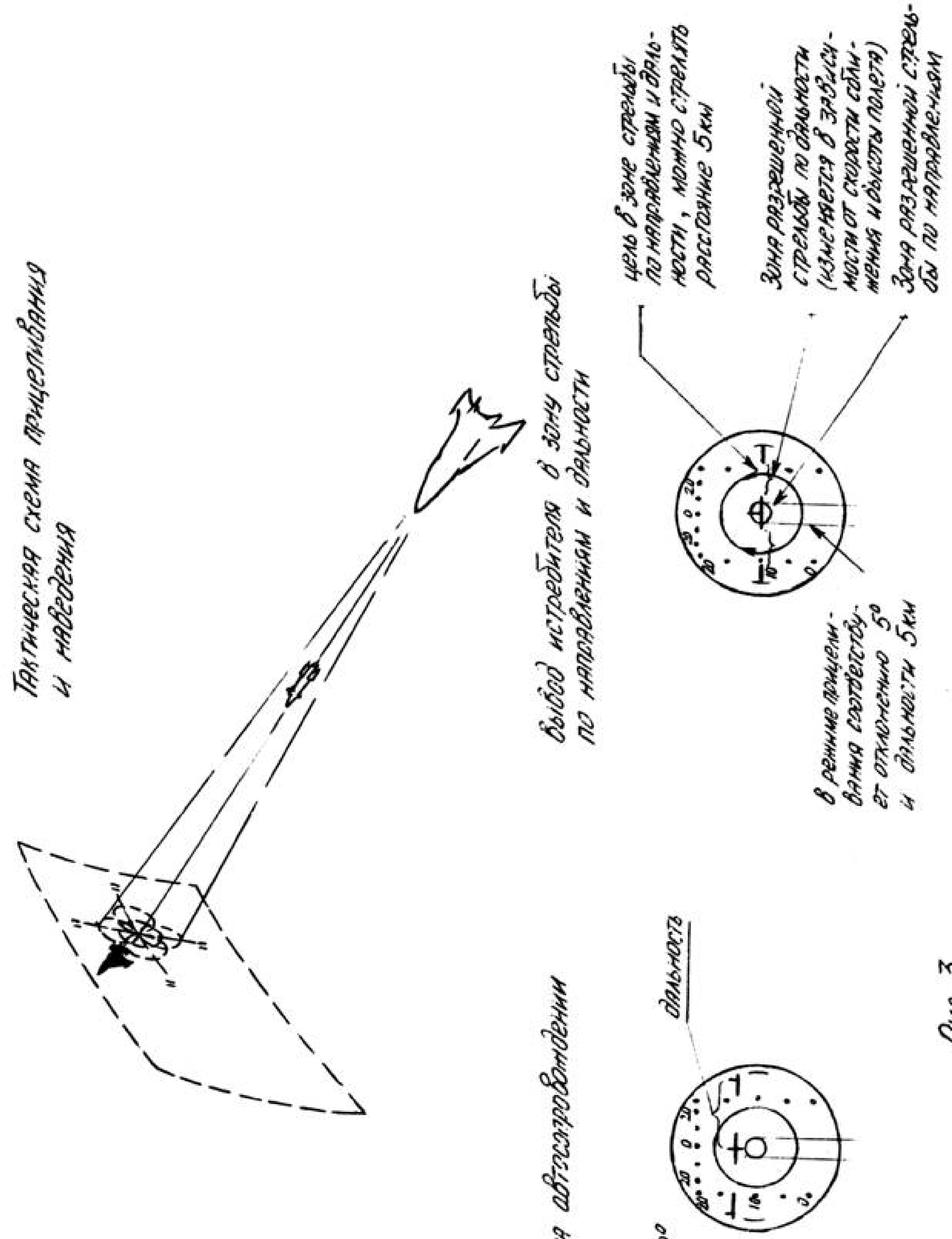
Тактическая схема прицеливания
и наведения
Вывод истребителя в зону стрельбы
по направлениям и дальности
цель в зоне стрельбы
по направлениям и дальности, можно стрелять
расстояние 5км
Зона разрешенной
стрельбы по дальности
(изменяется в зависимости от скорости сближения и высоты полета)
Зона разрешенной стрельбы по направлениям
В режиме прицеливания соответствует отклонению 5°
и дальности 5км
Захват цели на автосопровождении
дальность
цель смещена на 2°
расстояние 9км

Рис. 3

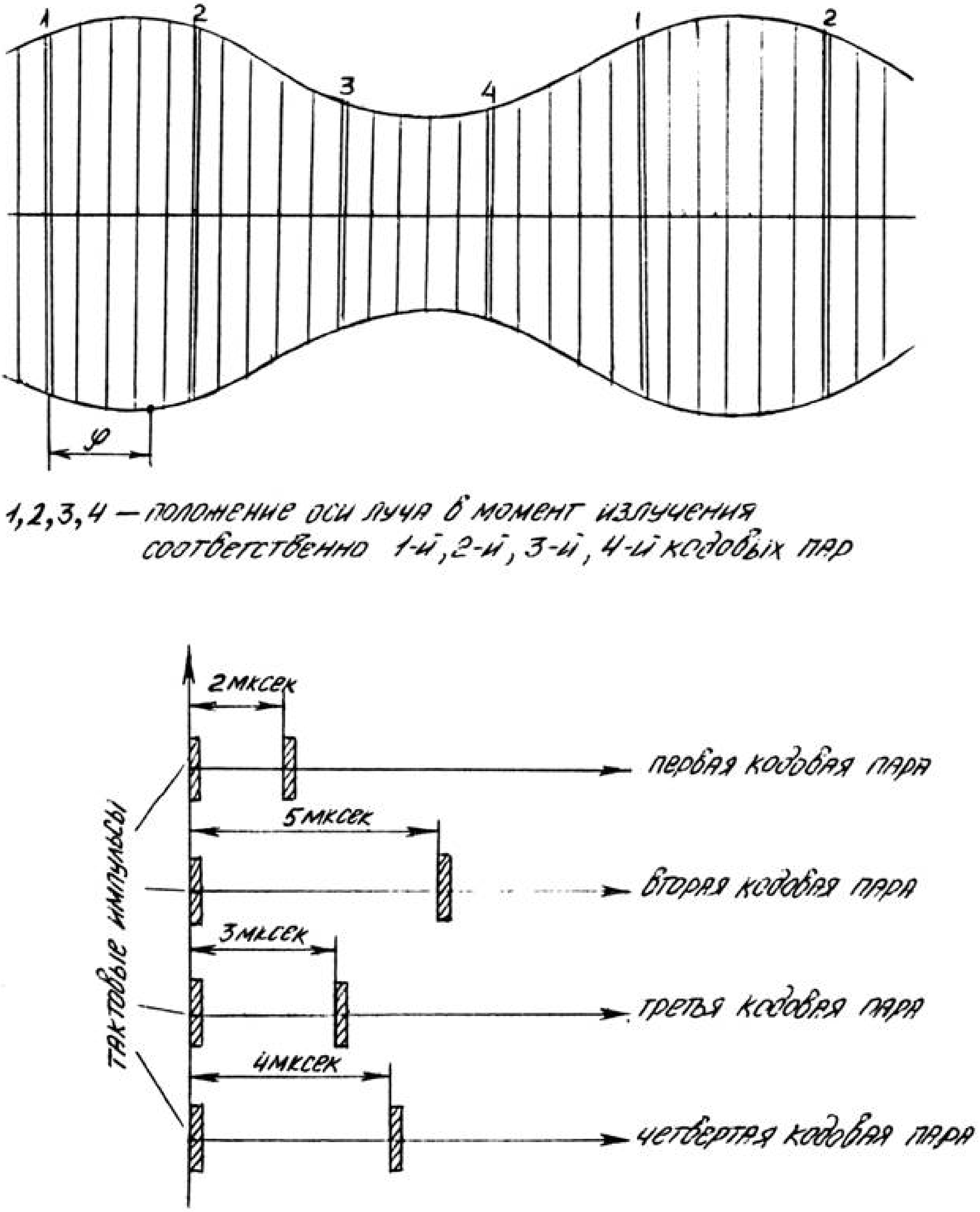

РИС. 8 Структура радиолуча станции ЦД-30

The projectile guidance mode with automatic target tracking is used when firing at a single target, regardless of visibility conditions in the absence of interference. Firing in this mode requires the pilot to pay less attention to the quality of piloting during firing, since the station automatically tracks the position of the target.

The guidance mode with a fixed beam is used in the presence of active and passive interference, when firing at a group or low-flying target. Shooting in this mode requires the pilot to pay more attention and to continuously accurately aim at the attacked target, since the station does not track the target.

The equal-signal antenna line in this mode is coupled with the axis of the optical process.

Depending on the situation, the pilot selects the projectile guidance mode and switches the station from one mode to another with the "Escort" - "Fix beam" - "Interference" toggle switch on the station control panel.

3. COMPOSITION OF THE STATION

The TsD-ZOT radar station includes the following units:

1. Antenna unit.
2. Sender-receiver unit.
3. Receiving block.
4. Indicator.
5. Scanner.
6. Block of magnetic amplifiers.
7. Synchronization block.
8. Auto selector.
9. Power supply unit.

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